REMARKS

Claims 2, 4-6, 9, 11-14, 27, 29-31, 34, 36-39 remain in the application. Underlining has been added to claims 26-47 introduced in the Preliminary Amendment filed January 24, 2000, as required by 37 CFR 1.173(d); no other changes have been made to these claims. Claims 1, 3, 7, 8, 10, 15-26, 28, 32, 33, 35 and 40-47 have been canceled without prejudice. No new matter has been added.

At ¶1 of the Office Action, the Examiner objects to the preliminary amendment filed January 24, 2000 because the new matter is not underlined. Accordingly, claims 26-47 have been amended to include underlining. That objection should therefore be withdrawn.

At ¶2 of the Office Action, the Examiner states that the reissue oath/declaration filed with this application is defective because it fails to contain a statement that all errors which are being corrected in the reissue application up to the time of filing the oath/declaration arose without any deceptive intention on the part of the applicant, pursuant to 37 CFR 1.175. Accordingly, a Supplemental Reissue Application Declaration is submitted herewith including such a statement. That objection should therefore be withdrawn. A joint inventor, Wayne C. Haase, is included in the supplemental declaration. A Petition for Correction of Inventorship of Patent under 37 C.F.R. §1.324 was filed in the U.S. Patent Office on October 26, 2001 to add the joint inventor (copies included herewith). Further, a 3.73(b) certificate submitted herewith includes an executed assignment from Wayne C. Haase to Michael A. Martinelli.

At ¶3 of the Office Action, the Examiner states that the reissue oath/declaration is defective because it does not identify the mailing or post office address of each inventor. The

aforementioned Supplemental Reissue Application Declaration includes those addresses. That objection should therefore be withdrawn.

At ¶4 of the Office Action, the Examiner has rejected claims 1-47 as being based on a defective reissue declaration. Since the Supplemental Declaration submitted herewith cures the defects, those rejections should be withdrawn.

At ¶5 of the Office Action, the Examiner has objected to the specification because of a missing reference to a related copending application. The Applicant has amended the specification to include the text suggested by the Examiner. That objection should therefore be withdrawn.

At ¶6 of the Office Action, the Examiner has rejected claims 1-22 under 35 U.S.C. 101 as claiming the same invention as claims 1-22 of copending Application No. 09/231,854. Since claims 1, 3, 7, 8, 10, and 15-22 have been canceled, that conflict no longer exists with respect to those claims and that objection should be withdrawn. With respect to remaining claims 2, 4, 5, 6, 9, and 11-14, the Applicant will amend the copending Application No. 09/231,854 appropriately so that claims 2, 4, 5, 6, 9, and 11-14 are no longer coextensive in scope. The rejections of claims 1-22 should therefore be withdrawn.

At ¶7 of the Office Action, the Examiner states that claims 1-22 conflict with claims 1-22 of Application No. 09/231,854. As noted above, the Applicant will amend the copending Application No. 09/231,854 appropriately so that claims 2, 4, 5, 6, 9, and 11-14 are no longer coextensive in scope

At ¶8 of the Office Action, the Examiner has rejected claims 1-3, 7-10, 13-28, 32-35 and 38-47 under 35 U.S.C. 102(e) as being anticipated by Acker et al., U.S. Patent No. 5,558,091

(the '091 patent). The Applicant has amended in a non-narrowing manner rejected claims 4, 11, 12, 29, 36, and 37 into independent form, changed the dependency on related claims 2, 9, 13, 27, 34 and 38 and canceled the remaining non-related claims without prejudice. These claims have been amended in accordance with the Examiner's statement regarding allowable claims at ¶9. Accordingly, the Applicant respectfully submits that newly amended claims 2, 4, 9, 11-13, 27, 29, 34, and 36-38 are now in condition for allowance. Those rejections should therefore be withdrawn.

All claims 2, 4, 9, 11-13, 27, 29, 34, and 36-38 are believed to be in condition for allowance. Passage to issue is requested.

The total number of claims has decreased from 47 to 12, and the number of independent claims has decreased from 12 to 6. Therefore, no additional claim fee is required. An extension fee of $920.00 pursuant to 37 CFR §1.136(a) for a reply within the third month is also enclosed. No additional costs are believed to be due in connection with the filing of this Amendment. <u>However, should any fees be due, please charge our Deposit Account No. 50-1133</u>. A copy of this page is enclosed for this purpose.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**<u>Version with markings to show changes made</u>**."

If the Examiner believes there are any outstanding issues to be resolved with respect to the above-identified application, he is invited to telephone the undersigned at his earliest convenience so that such issues may be resolved telephonically.

Respectfully submitted,

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Version with markings to show changes made

IN THE SPECIFICATION:

Please add the following text to the specification, beginning at page 1, line 1:

-- Application Serial No. 09/231,854, filed January 14, 1999, and Application Serial No. 09/494,213, filed January 14, 2000, are copending applications which each reissues of Application Serial No. 08/490,342, filed June 14, 1995, now U.S. Patent No. 5,592,939.--

IN THE CLAIMS:

As requested by the Examiner, a full set of new claims 26-47 with underlining as required by 37 CFR 1.173(d) are submitted herewith as an attachment.

Please cancel claims 1, 3, 7, 8, 10, 15-26, 28, 32, 33, 35 and 40-47 without prejudice, and amend claims 2, 4, 9, 11-13, 27, 29, 34, and 36-38 as follows: (All claims are shown for the convenience of the Examiner)

1. (Canceled)

2. (Amended) The method as recited in claim [1]4, wherein the step of inducing said set of orientation signal values comprises the steps of:

generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by a principal magnetic component in one axial dimension and relatively smaller magnetic components in two other axial dimensions.

3. (Canceled)

4. (Amended) [The method as recited in claim 3, wherein said generating step further includes the steps of:]A method of determining the location of a magnetically-sensitive, electrically conductive sensing coil affixed to a distal end of a catheter probe partially inserted into a body cavity within a navigational domain, comprising the steps of:

inducing within said sensing coil a set of orientation signal values each representative of

an orientation of said sensing coil and independent of a position of said sensing coil;

determining the orientation of said sensing coil using said induced orientation signal values;

inducing within said sensing coil a set of positional signal values each representative of the position of said sensing coil by generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by two principal gradient magnetic components in respective axial dimensions and a relatively smaller magnetic components in a third axial dimension;

generating said fields to provide a plurality of constant signal surfaces for the sensing coil such that an intersection between two such surfaces with components in the same axial dimensions produces a line along which said sensing coil is located;

wherein said two such surfaces are identified from among said plurality of constant signal surfaces by their ability to induce one of said positional signal values; and,

determining the position of said sensing coil using said positional signal values and said determined orientation.

5. The method as recited in claim 4, further comprises the steps of:

weighting each line in accordance with a signal strength of said corresponding constant signal surface; and

determining an intersection of said weighted lines.

6. The method as recited in claim 5, wherein six constant signal surfaces are generated to produce three intersection lines.

7. (Canceled)

8. (Canceled)

9. (Amended) The system as recited in claim [8]11, wherein [the first signal-inducing

means comprises:

field generation means for successively generating]each of the magnetic field patterns projected into said navigational domain[, each] is characterized substantially by a principal magnetic field component in one direction and relatively smaller magnetic components in two other directions.

10. (Canceled)

11. (Amended) [The system as recited in claim 10, wherein said magnetic coils are] A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil affixed to a distal end of a catheter probe partially inserted into a body cavity within a navigational domain, comprising:

first signal-inducing means for inducing within said sensing coil orientation signals that are representative of the orientation of said sensing coil, including field generation means for successively generating magnetic field patterns projected into said navigational domain, wherein said field generation means comprises a set of magnetic coils disposed in a planar top of an examination deck upon which a patient is disposed during a surgical procedure;

analysis means, coupled to said first signal-inducing means, for determining the orientation of said sensing coil using said induced orientation signals and independent from a position of said sensing coil;

second signal-inducing means for inducing within said sensing coil position signals that are representative of the position of said sensing coil; and

analysis means, coupled to said second signal-inducing means, for determining the position of said sensing coil using said determined orientation and said induced position signals.

12. (Amended) [The system as recited in claim 10, wherein said magnetic coils are] A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil affixed to a distal end of a catheter probe partially inserted into a body cavity within a navigational domain, comprising:

first signal-inducing means for inducing within said sensing coil orientation signals that are representative of the orientation of said sensing coil, including field generation means for successively generating magnetic field patterns projected into said navigational domain, wherein said field generation means comprises a set of magnetic coils disposed in a planar top and in rail members edge supported by said planar top for an examination deck upon which a patient is disposed during a surgical procedure;

analysis means, coupled to said first signal-inducing means, for determining the orientation of said sensing coil using said induced orientation signals and independent from a position of said sensing coil;

second signal-inducing means for inducing within said sensing coil position signals that are representative of the position of said sensing coil; and

analysis means, coupled to said second signal-inducing means, for determining the position of said sensing coil using said determined orientation and said induced position signals.

13. (Amended) The system as recited in claim [8]11, wherein the second signal-inducing means comprises:

field generation means for successively generating magnetic field patterns each characterized by a first and second gradient field component in respective directions and a relatively smaller third component in another direction.

14. The system as recited in claim 13, wherein the field generation means comprises a magnetic coil assembly.

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (Canceled)

22. (Canceled)

23. (Canceled)

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Amended) The method as recited in claim [26]29, wherein the step of inducing said set of orientation signal values comprises the steps of:

generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by a principal magnetic component in one axial dimension and relatively smaller magnetic components in two other axial dimensions.

28. (Canceled)

29. (Amended) [The method as recited in claim 28, wherein said generating step further includes the steps of:] A method of determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising the steps

of:

inducing within said sensing coil a set of orientation signal values each representative of an orientation of said sensing coil and independent of a position of said sensing coil;

determining the orientation of said sensing coil using said induced orientation signal values;

inducing within said sensing coil a set of positional signal values each representative of the position of said sensing coil by generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by two principal gradient magnetic components in respective axial dimensions and a relatively smaller magnetic components in a third axial dimension;

generating said fields to provide a plurality of constant signal surfaces for the sensing coil such that an intersection between two such surfaces with components in the same axial dimensions produces a line along which said sensing coil is located;

wherein said two such surfaces are identified from among said plurality of constant signal surfaces by their ability to induce one of said positional signal values; and,

determining the position of said sensing coil using said positional signal values and said determined orientation.

30. The method as recited in claim 29, further comprises the steps of:

weighting each line in accordance with a signal strength of said corresponding constant signal surface; and

determining an intersection of said weighted lines.

31. The method as recited in claim 30, wherein six constant signal surfaces are generated to produce three intersection lines.

32. (Canceled)

33. (Canceled)

34. (Amended) The system as recited in claim [33]36, wherein [the first signal-inducing means comprises:

field generation means for successively generating]each of the magnetic field patterns projected into said navigational domain[, each] is characterized substantially by a principal magnetic field component in one direction and relatively smaller magnetic components in two other directions.

35. (Canceled)

36. (Amended) [The system as recited in claim 35, wherein] A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising:

first signal-inducing means for inducing within said sensing coil orientation signals that are representative of the orientation of said sensing coil, including field generation means for successively generating magnetic field patterns projected into said navigational domain, wherein said field generation means comprises a set of magnetic coils and said magnetic coils are disposed in a planar top of an examination deck upon which a patient is disposed during a surgical procedure;

analysis means, coupled to said first signal-inducing means, for determining the orientation of said sensing coil using said induced orientation signals and independent from a position of said sensing coil;

second signal-inducing means for inducing within said sensing coil position signals that are representative of the position of said sensing coil; and,

analysis means, coupled to said second signal-inducing means, for determining the position of said sensing coil using said determined orientation and said induced position signals.

37. (Amended) [The system as recited in claim 35, wherein] A system for determining the

location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising:

first signal-inducing means for inducing within said sensing coil orientation signals that are representative of the orientation of said sensing coil, including field generation means for successively generating magnetic field patterns projected into said navigational domain, wherein said field generation means comprises a set of magnetic coils and said magnetic coils are disposed in a planar top and in rail members edge supported by said planar top for an examination deck upon which a patient is disposed during a surgical procedure;

analysis means, coupled to said first signal-inducing means, for determining the orientation of said sensing coil using said induced orientation signals and independent from a position of said sensing coil;

second signal-inducing means for inducing within said sensing coil position signals that are representative of the position of said sensing coil; and,

analysis means, coupled to said second signal-inducing means, for determining the position of said sensing coil using said determined orientation and said induced position signals.

38. (Amended) The system as recited in claim [33]36, wherein the second signal-inducing means comprises:

field generation means for successively generating magnetic field patterns each characterized by a first and second gradient field component in respective directions and a relatively smaller third component in another direction.

39. The system as recited in claim 38, wherein the field generation means comprises a magnetic coil assembly.

40. (Canceled)

41. (Canceled)

42. (Canceled)

43. (Canceled)

44. (Canceled)

45. (Canceled)

46. (Canceled)

47. (Canceled)

ATTACHMENT

New Claims 26-47 with Underlining as Required by 37 CFR 1.173(d)

26. A method of determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising the steps of:

inducing within said sensing coil a set of orientation signal values each representative of an orientation of said sensing coil and independent of a position of said sensing coil;

determining the orientation of said sensing coil using said induced orientation signal values;

inducing within said sensing coil a set of positional signal values each representative of the position of said sensing coil; and

determining the position of said sensing coil using said positional signal values and said determined orientation.

27. The method as recited in claim 26, wherein the step of inducing said set of orientation signal values comprises the steps of:

generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by a principal magnetic component in one axial dimension and relatively smaller magnetic components in two other axial dimensions.

28. The method as recited in claim 27, wherein the step of inducing said set of positional signal values comprises the steps of:

generating from outside said body a series of magnetic fields each penetrating at least said navigational domain and characterized substantially by two principal gradient magnetic components in respective axial dimensions and a relatively smaller magnetic components in a third axial dimension.

29. The method as recited in claim 28, wherein said generating step further includes the steps of:

generating said fields to provide a plurality of constant signal surfaces for the sensing coil such that an intersection between two such surfaces with components in the same axial dimensions produces a line along which said sensing coil is located;

wherein said two such surfaces are identified from among said plurality of constant signal surfaces by their ability to induce one of said positional signal values.

30. The method as recited in claim 29, further comprises the steps of:

weighting each line in accordance with a signal strength of said corresponding constant signal surface; and

determining an intersection of said weighted lines.

31. The method as recited in claim 30, wherein six constant signal surfaces are generated to produce three intersection lines.

32. A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising:

first transmit means for projecting into said navigational domain magnetic energy that is sufficient to induce signal values within said sensing coil representative of an orientation of said sensing coil and independent of the position of said sensing coil;

second transmit means for projecting into said navigational domain magnetic energy that is sufficient to induce signal values within said sensing coil representative of the position of said sensing coil; and

analysis means, coupled to said first transmit means and said second transmit means, for determining the position and orientation of said sensing coil from said induced signal values.

33. A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising:

first signal-inducing means for inducing within said sensing coil orientation signals that are representative of the orientation of said sensing coil;

analysis means, coupled to said first signal-inducing means, for determining the orientation of said sensing coil using said induced orientation signals and independent from a position of said sensing coil;

second signal-inducing means for inducing within said sensing coil position signals that are representative of the position of said sensing coil; and

analysis means, coupled to said second signal-inducing means, for determining the position of said sensing coil using said determined orientation and said induced position signals.

34. The system as recited in claim 33, wherein the first signal-inducing means comprises:

field generation means for successively generating magnetic field patterns projected into said navigational domain, each characterized substantially by a principal magnetic field component in one direction and relatively smaller magnetic components in two other directions.

35. The system as recited in claim 34, wherein said field generation means comprises a set of magnetic coils.

36. The system as recited in claim 35, wherein said magnetic coils are disposed in a planar top of an examination deck upon which a patient is disposed during a surgical procedure.

37. The system as recited in claim 35, wherein said magnetic coils are disposed in a planar top and in rail members edge supported by said planar top for an examination deck upon which a patient is disposed during a surgical procedure.

38. The system as recited in claim 33, wherein the second signal-inducing means comprises:

field generation means for successively generating magnetic field patterns each characterized by a first and second gradient field component in respective directions and a relatively smaller third component in another direction.

39. The system as recited in claim 38, wherein the field generation means comprises a magnetic coil assembly.

40. A method of determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising the steps of:

defining the location of said sensing coil with a set of independent location parameters; and

sequentially generating within said navigational domain a sequence of magnetic fields for inducing within said sensing coil a corresponding sequence of induced signals each defined by an induced signal expression that functionally relates said induced signal to certain ones of said location parameters, such that said set of location parameters is determinable by sequentially solving individual signal expression groups each including certain ones of said induced signal expressions and sufficient to represent a subset of said location parameters.

41. The method as recited in claim 40, wherein said sequence of magnetic fields comprises:

a series of unidirectional magnetic fields each characterized substantially by a principal magnetic field component in one direction and relatively smaller magnetic components in two other directions; and

a series of gradient magnetic fields each characterized by a first and second gradient field component in respective directions and a relatively smaller third component in another direction.

42. The method as recited in claim 41, wherein said signal expression groups include:

an orientation group including induced signal expressions each functionally related to a respective one of said unidirectional magnetic fields and an orientation of said sensing coil, and independent of a position of said sensing coil; and

a position group including induced signal expressions each functionally related to a respective one of said gradient magnetic fields, the orientation of said sensing coil, and the position of said sensing coil.

43. The method as recited in claim 42, wherein the step of sequentially solving said individual signal expression groups includes the steps of:

initially solving the induced signal expressions of said orientation group; and

next solving the induced signal expressions of said position group.

44. A system for determining the location of a magnetically-sensitive, electrically conductive sensing coil in a navigational domain within a body, comprising:

means for defining the location of said sensing coil with a set of independent location parameters; and

field generation means for sequentially generating within said navigational domain a sequence of magnetic fields for inducing within said sensing coil a corresponding sequence of induced signals each defined by an induced signal expression that functionally relates said induced signal to certain ones of said location parameters, such that said set of location parameters is determinable by sequentially solving individual signal expression groups each including certain ones of said induced signal expressions and sufficient to represent a subset of said location parameters.

45. The system as recited in claim 44, wherein said sequence of magnetic fields comprises:

a series of unidirectional magnetic fields each characterized substantially by a principal magnetic field component in one direction and relatively smaller magnetic components in two other directions; and

a series of gradient magnetic fields each characterized by a first and second gradient field component in respective directions and a relatively smaller third component in another direction.

46. The system as recited in claim 45, wherein said signal expression groups include:

an orientation group including induced signal expressions each functionally related to a respective one of said unidirectional magnetic fields and an orientation of said sensing coil, and independent of a position of said sensing coil; and

a position group including induced signal expressions each functionally related to a respective one of said gradient magnetic fields, the orientation of said sensing coil, and the position of said sensing coil.

47. The system as recited in claim 46, wherein said field generation means comprises:

analysis means for solving the induced signal expressions of said orientation group; and

analysis means for solving the induced signal expressions of said position group.